We can find out when Alexei will have paid off his loan.

➤ Use the graph.
At 7 months, the amount owed is approximately zero.
This means that Alexei has paid off the loan.

➤ Use the equation.
The amount Alexei owes is $0.
Substitute $A = 0$, then solve for t.

$$A = 1700 - 250t$$
$$0 = 1700 - 250t \qquad \text{Add } 250t \text{ to each side.}$$
$$250t = 1700 - 250t + 250t$$
$$250t = 1700 \qquad \text{Divide each side by 250.}$$
$$\frac{250t}{250} = \frac{1700}{250}$$
$$t = 6.8$$

When we add $250t$ to each side, then divide each side by 250, we are using inverse operations.

Since the number of months is a whole number,
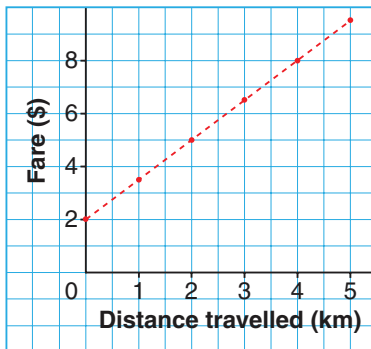it takes Alexei 7 months to pay off his loan.

Practice

Your teacher will provide larger copies of the graphs in this section.

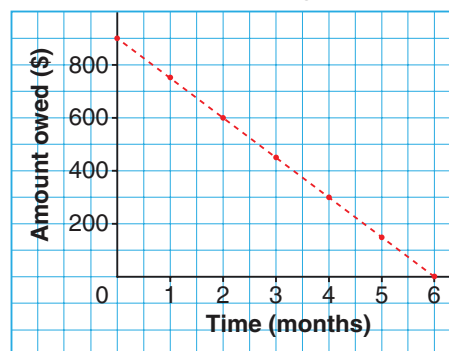**1.** For each graph, make a table of values.
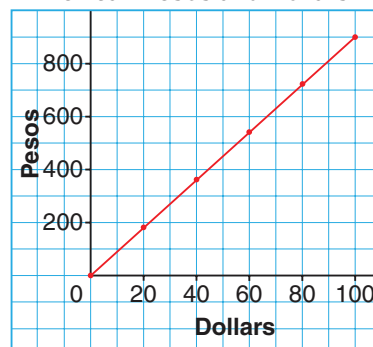
a) **Taxi Fares**
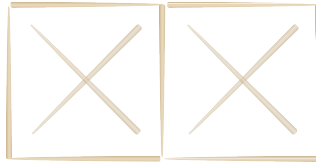

b) **Laurie's Loan Repayments**

c) **Relationship between Mexican Pesos and Dollars**

2. Rosa made this pattern with toothpicks. She continued it for 7 frames.


| Frame 1 | Frame 2 | Frame 3 |

Rosa drew this graph.

a) Does this graph represent direct variation or partial variation? How do you know?

b) Make a table of values to show how many toothpicks are needed for each frame.

c) Write an equation that relates the number of toothpicks, T, and the frame number, n.

d) How many toothpicks would you need to build the 17th frame in this pattern? Which method did you use to find out?
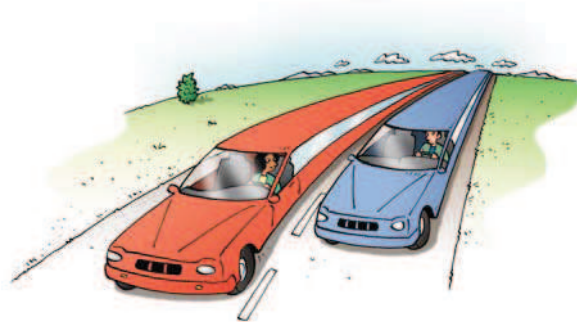
Toothpicks Used in Pattern
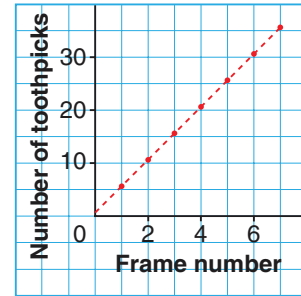
3. The graph below models the motion of two cars.

a) Use the graph. Copy and complete the table.

Distance Travelled by Two Cars

Time (h)	Car A Distance (km)	Car B Distance (km)
0		
0.5		
1		
1.5		
2		

b) For each car, write an equation that relates distance, d kilometres, and time, t hours.

c) Which car has the greater average speed? How do you know?

d) How far has each car travelled after 1.75 h?

e) How long does it take each car to travel 110 km?

238   CHAPTER 6: Linear Relations

We can graph a relation from its description.

Example

Ashok and Katie each recorded a distance for a ball rolling over a period of time.
Ashok found that the ball rolled 9 m in 3 s.
Katie found that the ball rolled 6 m in 2 s.
a) Draw a distance-time graph for the ball.
Assume the ball continues at the same average speed.
b) When will the ball have rolled 10 m?
c) Write an equation that relates the distance, d metres, and the time, t seconds.
d) Use the equation.
   How far did the ball roll in 8 s?
e) Compare your solutions in parts b and d.

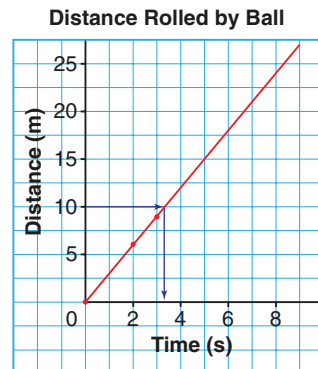**Solution**   a) Complete a table of values.
Graph the data.

Time, t (s)	0	2	3
Distance, d (m)	0	6	9

The points lie along a straight line that passes through the origin.
Extend the line.

Distance Rolled by Ball

b) To determine when the ball rolled 10 m, use the graph.
From the graph, the ball reached 10 m after about 3.3 s.

c) The situation is modelled by direct variation.
Distance in metres = average speed in m/s × time in seconds
The average speed is the rate of change.
The ball rolled 9 m in 3 s.

Average speed $= \dfrac{distance}{time}$
$= \dfrac{9\ m}{3\ s}$
$= 3$ m/s

> The graph will not go on forever. The ball will eventually slow down and stop.

So, distance in metres = 3 m/s × time in seconds
The equation is: $d = 3t$

d) To determine how far the ball rolled in 8 s, substitute $t = 8$.
$d = 3 \times 8$
$= 24$

e) In part b, from the graph, the answer was approximate.
To determine the answer, the graph was extended to the right.
Drawing the graph helps visualize the relationship between
the quantities.
In part d, from the equation, the answer was exact.

4. Liam sells jewellery.
He earns a basic wage, plus commission.
Liam earned $550 when he sold $1000 worth of jewellery.
He earned $750 when he sold $5000 worth of jewellery.
How much does Liam earn when he sells $6000 worth of jewellery?
a) Use a table to solve the problem.
b) Use an equation to solve the problem.
c) Which method in parts a and b do you prefer? Explain.
d) How could you have solved the problem a different way? Explain.

5. **Assessment Focus**   Rain water is collected in a 350-L barrel.
During one storm, the volume of water in the barrel
after 1 min was 65 L.
The volume after 5 min was 125 L.
Suppose water continues to be collected at this rate.
a) How many minutes will it take for the barrel to fill?
b) How many different ways could you determine
the answer to part a?
Describe each way.
Which way do you prefer?

6. Suppose the rate of water collection in question 5 was 12 L per minute.
How many minutes would it take for the barrel to fill?

7. **Take It Further**   Use the table.
a) Write an equation to show the relationship
between the distance, d, and time, t.
b) Describe a situation that could be modelled
by this table and equation.

Time, t (min)	0	1	2	3	4
Distance, d (m)	3	5	7	9	11

In Your Own Words

Describe how to write an equation of a relationship when you are
given its graph. Use an example in your answer.